
CHAPTER IV B

Sacramento National Wildlife Refuge Alternative Plans



U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
MID-PACIFIC REGION

CHAPTER IV B

SACRAMENTO NATIONAL WILDLIFE REFUGE

Sacramento National Wildlife Refuge (NWR) was established in 1937 through the purchase of 10,776 acres under Executive Order 7562 with funds from the Emergency Conservation Fund Act of 1933 and Emergency Relief Appropriations for the purpose of providing a refuge and breeding grounds for migratory birds and wildlife. The refuge, managed by the Service, provides wintering and resting areas for ducks and geese and reduces waterfowl damage to crops on neighboring farms. Additional land was purchased using Land, Water and Conservation Act Funds. The refuge is located about five miles south of the City of Willows in Glenn and Colusa Counties, west of the Sacramento River.

The Sacramento NWR is part of a group of refuges located in the Colusa Basin which is a drainage area extending from Stony Creek in the north to Cache Creek in the south; and between the Sacramento River on the east and the Coast Range Mountains on the west. Historically, flood waters from the Sacramento River and the east side of the Coast Range Mountains flooded the marshes in the Colusa Basin during the winter and spring. Flood control projects have minimized the flooding, however wetland habitat does occur within the "Colusa Trough" and within flooded rice fields. The Colusa Basin also includes Delevan NWR, and Colusa NWR, as well as numerous private duck clubs. The clubs primarily flood the marshes during the hunting season. Small marsh areas occur near agricultural sumps that collect agricultural run-off. The clubs near the Sacramento NWR generally flood the marshes in August or September to accommodate the needs of pintail ducks that arrive in August.

Sacramento NWR consists of ponds, rice fields, and millet fields. Rice is farmed with some rice left remaining in the fields to be used as waterfowl food. Millet is grown solely as waterfowl food. Approximately 50 percent of the water requirement is used in the rice and millet field areas of the refuge. The natural ponds also support sources of waterfowl food such as timothy grass and invertebrate populations. The upland areas of the refuge provide habitat for geese, upland birds, and other wildlife species. The amount of land used for fields, ponds, and upland uses varies depending upon the amount of water available.

A. WATER RESOURCES

Sacramento NWR holds no firm water rights and receives CVP water on an as-available basis from the Sacramento River and Stony Creek. The total water requirement for full refuge development under the existing management plan is estimated to be 50,000 acre-feet.

1. Surface Waters

CVP water is transported from the Sacramento River at the Red Bluff Diversion Dam through the Tehama-Colusa Canal to the western Sacramento Valley, including the Colusa Basin refuges. Diversions from the Tehama-Colusa Canal provide water to Stony Creek, the Wasteway Cross Channel, and the Williams Outlet. The Wasteway cross channel, with a capacity of 1,000 cfs, and the Williams outlet are facilities specifically constructed to provide water directly to the Glenn-Colusa Irrigation District (GCID) Canal. The Canal is used for the delivery of water to district lands, of which the refuge is included and represents only a small portion. Williams outlet is located approximately 25 miles south of the refuge. The GCID includes 175,000 acres of which 136,000 acres are irrigable.

Stony Creek is also a water source for GCID. Releases to Stony Creek are subsequently diverted by GCID six miles downstream. Stony Creek is not recognized under Contract No. 14-06-200-8181A with the Service as a point of delivery from the Tehama-Colusa Canal. Releases to Stony Creek from either the Tehama-Colusa Canal or Butte Reservoir are rarely made due to high transportation losses experienced. GCID is entitled to only 10,000 acre-feet of emergency water from Stony Creek. The Reclamation has the option of providing that water from Stony Creek or from the Sacramento River via The Tehama-Colusa Canal.

GCID conveys CVP water or provides GCID water through exchange agreements with the CVP to the Colusa Basin refuges. The GCID Main Canal is 65 miles long and has a capacity of 3,000 cfs. A pumping station at Hamilton City pumps water from the Sacramento River into the Main Canal. Water is diverted from the Main Canal into more than 420 miles of irrigation laterals. A portion of the water supplied by GCID is from agricultural return flows. Under Contract 14-06-200-8181A, GCID conveys a yearly maximum of 50,000 acre-feet to the Sacramento NWR. The contracts provide for a 25 percent conveyance loss. Based upon existing data, the quality of water delivered by GCID appears to be suitable for irrigation under most conditions. Agricultural return flows are generally of poorer quality, especially for flows that are re-used several times.

Agricultural return flows are currently diverted from Logan Creek under appropriative water rights acquired by Sacramento NWR. The refuge has four licenses that permit the diversion of 60 cfs to supply 4,575 acres of the refuge. The rights are subject to depletion by other water rights with earlier priority dates or higher priorities. Water may not be available from the Logan Creek Drain during July and August due to lack of water. In Logan Creek, water quality may be poorer during the late agricultural season due to the high percentage of agricultural return flows as compared to fresh water flows. The historical water supplies to Sacramento NWR are summarized in Table IV B-1.

TABLE IV B-1
WATER DELIVERIES
SACRAMENTO NWR
(acre-feet)

Year	Glenn-Colusa Irrigation District		Logan Creek Drain				Subtotal ^(a)	Total ^(b)
	26-2 Lateral	26-2 Supplemental	35-1C	Dam 1	Dam 2	Dam 3		
1977	15,477	2,497	0	5,013	0	2,718	25,705	34,265
1978	20,892	3,642	0	8,440	1,015	4,681	38,670	51,547
1979	18,776	1,376	0	11,861	0	1,824	33,837	45,105
1980	17,563	754	4,737	10,319	0	4,420	37,793	50,378
1981 (c)	19,382	0	996	10,154	0	2,557	33,089	44,108
1982 (c)	13,201	0	1,612	7,740	2,700	2,653	27,906	37,199
1983 (c)	15,770	0	0	9,064	0	1,998	26,832	35,767
1984 (c)	15,374	2,460	1,683	8,720	0	986	29,223	38,954
1985 (c)	19,684	1,111	0	1,029	0	2,190	24,014	32,011
1986 (c)	21,892	1,773	1,438	5,156	0	3,197	33,456	44,597

Notes:

(a) With conveyance losses

(b) Without conveyance losses

(c) Data provided by Glen-Colusa Irrigation District.

Source: USBR, 1986a

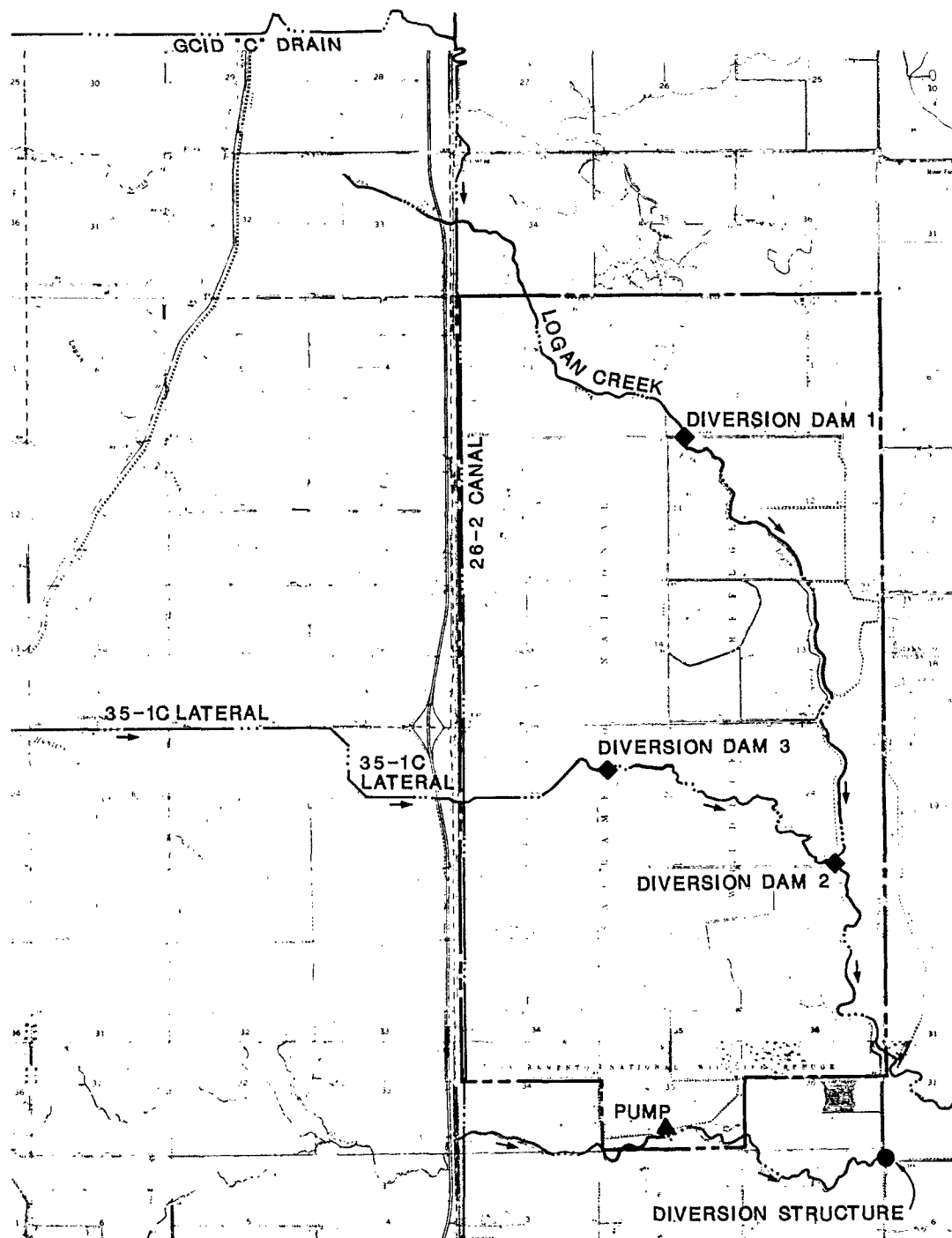
Water supply problems are related to the shut down of the Tehama-Colusa Canal during the winter. The Tehama-Colusa Canal has been used to provide water to GCID Main Canal during the winter months. However, the Reclamation and Service are concerned about loss of fish at the fish passage structures for the Red Bluff Diversion Dam. Therefore, these agencies are currently conducting a study which will be completed in 1992 to determine the effects of the fish passage structures on fishery resources in the Sacramento River. Starting in the Winter of 1986-87, the gates at the Red Bluff Diversion Dam remained open to allow unimpeded movement of winter-run Chinook salmon adults and downstream migration of juveniles. The opening of the gates is presently a year-to-year experiment with no commitment to a long-term operation.

Without the water from the Tehama-Colusa Canal, water must be provided to the GCID Main Canal from other sources, such as Paskenta and/or Black Butte Reservoirs. Paskenta Dam would need to be authorized and constructed before water could be provided via Thomes Creek and the Tehama-Colusa Canal to the refuge. Black Butte Reservoir is located on Stony Creek approximately nine miles upstream of Orland. The reservoir was constructed by the Corps of Engineers for flood control purposes. The conservation storage of Black Butte Reservoir was integrated into the Central Valley Project. At present, there is 38,000 acre-feet of uncommitted water available from Black Butte Reservoir during normal water years.

2. Water Conveyance Facilities

The GCID supplies water from the Main Canal (to the west of the refuge) to Sacramento NWR through Lateral 26-2 and Lateral 35-1C, as shown in Figure IV B-1. The capacity of these canals is limited to 90 cfs for Lateral 26-2 and 25 cfs for Lateral 35-1C. The canals supply water to the refuge from April to November.

Lateral 26-2 provides water by gravity flow to the western and northern portion of the refuge. However, this canal is shut down for maintenance at the end of November. Water from Logan Creek is diverted at Diversion Dam 1 to serve the northern portion of the refuge when Lateral 26-2 is not operating. Diversion Dams 2 and 3 require modification to allow more consistent operations during flood periods. Currently, these diversion dams are removed during flood periods and are not replaced until after the wet weather season. The flows in Logan Creek depend upon upstream agricultural return flows and may vary significantly throughout the year. The quality of Logan Creek water is related to the quality of the agricultural return water and is poorer than the quality of fresh water. Water also may be pumped from Lateral 35-1C into Lateral 26-2 to serve the southern portion of the refuge.



LEGEND

- REFUGE BOUNDARY
- WATER COURSE
- DIRECTION OF FLOW

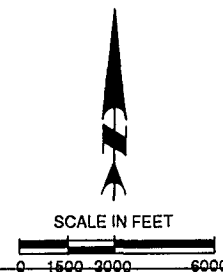


FIGURE IV B-1

SACRAMENTO NATIONAL WILDLIFE REFUGE EXISTING WATER SUPPLY FACILITIES



During the winter months, water is diverted into Lateral 35-1C from the GCID Main Canal. This diversion is difficult when the water level is low due to the higher elevation of the diversion structure. To aid in the diversion of water, GCID creates a 10-mile long backwater pool in the GCID Main Canal. Water then flows by gravity from Lateral 35-1C to a lift pump which provides water to the southern portion of the refuge.

The refuge reuses water to maximize the water use and maintain circulation in the ponds. However, re-circulation is difficult without construction of several lift stations, return canals, and underground power lines to serve the lift stations. The water flows through three to four ponds prior to discharge to Logan Creek or other drainage facilities. Water that returns to Logan Creek from the northern portion of the refuge can be re-diverted at Diversion Dams 2 and 3 for reuse on the southern portion of the refuge. The refuge receives a seven percent return-flow and water right credit from GCID to compensate for re-diverted flows. This credit is generally between 2,800 and 3,300 acre-feet per year.

3. Groundwater

Sacramento NWR is located in low-lying alluvial plains and fans of the Coast Range Mountains underlain by the Tehama Formation. The southeastern portion of the refuge is located within flood plain deposits of the Sacramento River flood basin. The groundwater is located within 10 to 25 feet of the ground surface. Based upon existing data, the quality appears to be suitable for irrigation and waterfowl needs. The safe yield of the aquifer under Sacramento NWR has been estimated by the Reclamation to be 12,900 acre-feet.

Groundwater is not currently used for water supply on the refuge. Two wells were drilled on the refuge in 1978. One well was developed and has a capacity to provide 1,200 gpm. This well was drilled to a depth of 260 feet. The other well was drilled to a depth of 195 feet and produced less than 500 gpm. This second well was not completely developed.

B. FORMULATION & EVALUATION OF ALTERNATIVE PLANS

Sacramento NWR has relied upon available water supplies to meet its water demands. To provide for full development of the refuge, the annual water requirement is 50,000 acre-feet. However, for the purposes of assessing the impacts of water delivery alternatives, four levels of water supply have been identified, as presented in Table IVB-2. Each of the water supply levels provide a different rate and volume of water, and are summarized as follows:

Level 1 - Existing firm water supply

Level 2 - Current average annual water deliveries

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TABLE IV B-2
DEPENDABLE WATER SUPPLY NEEDS
ALTERNATIVE SUPPLY LEVELS FOR THE SACRAMENTO NWR

Month	Supply Level 1		Supply Level 2		Supply Level 3		Supply Level 4	
	ac-ft	cfs	ac-ft	cfs	ac-ft	cfs	ac-ft	cfs
January	0	0.0	1,200	19.5	1,250	20.3	1,250	20.3
February	0	0.0	1,200	21.6	1,250	22.5	1,250	22.5
March	0	0.0	300	4.9	1,250	20.3	1,250	20.3
April	0	0.0	300	5.0	300	5.0	300	5.0
May	0	0.0	2,100	34.2	2,250	36.6	2,250	36.6
June	0	0.0	2,600	43.7	2,750	46.2	2,750	46.2
July	0	0.0	4,000	65.1	4,200	68.3	4,200	68.3
August	0	0.0	6,300	102.5	6,700	109.0	6,700	109.0
September	0	0.0	7,500	126.0	7,900	132.8	7,900	132.8
October	0	0.0	9,300	151.3	9,850	160.2	9,850	160.2
November	0	0.0	8,300	139.5	8,800	147.9	8,800	147.9
December	0	0.0	3,300	53.7	3,500	56.9	3,500	56.9
Total	0	0.0	46,400	766.9	50,000	826.1	50,000	826.1
Maximum	0	0.0	9,300	151.3	9,850	160.2	9,850	160.2

Notes:

- Alternative 1 Existing firm water supply
- Alternative 2 Current average annual water deliveries
- Alternative 3 Full use of existing development
- Alternative 4 Optimum management

Sources: USBR, 1986a; USFWS, 1986d

Level 3 - Water supply needed for full use of existing development

Level 4 - Water supply needed for optimum management

Multi-objective project evaluation procedures, in accordance with concepts outlined by the Water Resources Council, is one of the tools used in evaluating and comparing alternatives. The Water Contracting EIS's will evaluate the national, regional, and site specific environmental impacts of providing water to the refuges and other users under the different water supply levels. Based on the results of the Water Contracting EIS's, water supply levels will be identified for each refuge. Following completion of the Water Contracting EIS's, the plans to meet the identified water level will be compared under the National Economic Development Account, Environmental Quality Account, and Social Account.

The beneficial and adverse effects of each alternative to provide additional water in the western portion of the refuge also were compared with respect to the criteria listed in Chapter III. A summary comparison of the alternatives to provide additional water to the refuge for water delivery Levels 1, 2, 3, and 4 is presented in Table IV B-3.

Delivery alternatives have been considered to convey four of the identified levels of water supply described above. The alternatives presented below were primarily developed to provide water to the refuge during the winter when CVP water is not available through the Tehama-Colusa Canal and existing GCID facilities. However, because the CVP water is not provided as a firm supply, all of the alternatives include the request to continue to obtain CVP water through GCID facilities.

1. Delivery Alternative for Level 1 (No Action Alternative)

Because the Sacramento NWR does not have a firm water supply, no facilities are required.

2. Delivery Alternatives for Level 2

This level of water delivery represents the current average annual water delivery. Additional water conveyance facilities would not be needed if water was available during the winter from the Tehama-Colusa Canal and the GCID laterals. The alternatives discussed below have been developed to increase the dependability of the water deliveries during the winter months. The alternatives have been developed based on the assumption that the diversion gates at the Red Bluff Diversion Dam will

TABLE IV B-3
SUMMARY COMPARISON OF WATER DELIVERY ALTERNATIVES
SACRAMENTO NWR

	Supply Level 2, 3, & 4				
	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Availability of Water Supply	Yes	Maybe	No	No	Maybe
Ability to Convey Water	Yes	Yes	Yes	Yes	Yes
Need New Water	Yes	Yes	Yes	Yes	No
Need New Conveyance Agreements	Yes	Yes, maybe difficult	Yes	Yes	No
Type of Water Supply	Fresh Water	Fresh Water	Fresh Water	Fresh Water	Groundwater
Operational Flexibility	Yes	Yes	Yes	Maybe	Yes
Wildlife Habitat	Improve	Improve	Improve	Improve	Improve
Public Use	Unknown	Unknown	Unknown	Unknown	Unknown
Total Annual Costs \$(a)	176,120	231,930	286,480	193,850	231,120

Notes: Alternative A: Construct Flood Gate on Stony Creek.
Alternative B: Deliver CVP Water through Kanawha W.P.
Alternative C: Construct Pipeline to Transport CVP Water from Tehama-Colusa Canal.
Alternative D: Deliver CVP Water from Tehama-Colusa Canal to GCID Lateral 34-1C.
Alternative E: Conjunctive Use.

(a) Total Annual Costs includes annualized construction cost, annual operation and maintenance cost, annual power and wheelage cost.

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remain open during future winter seasons. Although the facilities discussed below are not needed to convey water during the summer months, the improvements would enhance water conveyance for the refuge and for GCID.

Alternative A - Construct Flood Gate on Stony Creek. Under this plan, water could be released from Black Butte Reservoir to Stony Creek, diverted into the GCID Main Canal, and subsequently diverted into GCID Lateral 26-2. This alternative cotemplates using the 38,000 acre-feet of uncommitted water in Black Butte Reservoir. This alternative would require construction of a permanent diversion structure with a "removable" flood gate where the GCID Main Canal crosses Stony Creek, as shown in Figure IV B-2. In addition, headgates on the GCID Lateral 26-2 could be improved to reduce the time required for maintenance. Although this alternative could continue to utilize the GCID Main Canal, portions of the canal could be dewatered during the winter. The GCID Main Canal would continue to be closed for a portion of the winter for maintenance. However, GCID indicated that the maintenance shut down period could be delayed until the refuge is flooded. Another alternative of conveying the Black Butte water is through the facilities of the Orland Project to the Tehama-Colusa Canal. Orland Project's south canal and lateral 40 were used during the winter of 1986-87 while the Red Bluff Diversion Dam Gates were open.

Alternative B - Deliver CVP Water through Kanawha Water District. CVP water would be delivered from the Sacramento River through the Kanawha Water District to the GCID "C" Drain, a branch of Logan Creek. The "C" Drain would convey the water under Interstate Highway 5, the frontage road, and the Southern Pacific Railroad tracks to the crossing of the "C" Drain and the GCID Lateral 26-2 near County Road 57. A pump station would be constructed at this crossing to lift the water about 7 feet from the "C" Drain into Lateral 26-2. This alternative would require winter operation of the Tehama-Colusa Canal. However, Alternative B would require a wheeling agreement with Kanawha Water District.

Alternative C - Construct Pipeline to Transport CVP Water from Tehama-Colusa Canal. Under this alternative, CVP water could be conveyed from the Tehama-Colusa Canal through an existing pipeline which extends to County Road D. A new pipeline could be constructed from Road D to an existing pipeline located immediately west of the GCID Main Canal. The existing pipeline discharges into North Fork Logan Creek near County Road 60. The North Fork Logan Creek, or the GCID C-11 Drain, conveys water under Interstate Highway 5, a frontage road, and the Southern Pacific Railroad tracks upstream of the crossing of GCID Lateral 26-2. A pump station could be constructed to lift water about 7 feet in elevation from the C-11 Drain into Lateral 26-2 at a location approximately one-half mile north of the Sacramento NWR boundary.

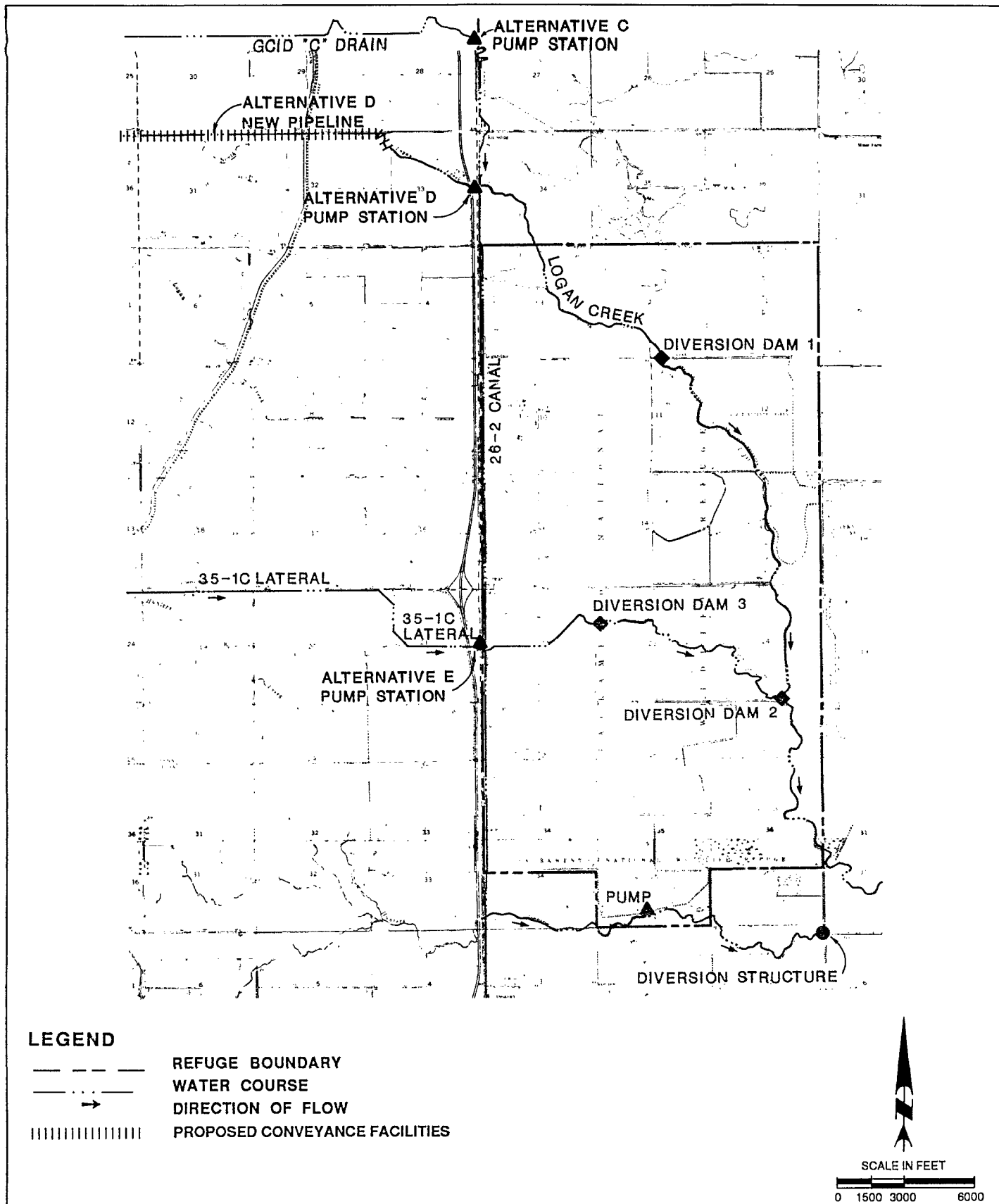


FIGURE IV B-2

SACRAMENTO NATIONAL WILDLIFE REFUGE
PROPOSED WATER SUPPLY FACILITIES
ALTERNATIVES C, D, & E

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Alternative D - Deliver CVP Water from Tehama-Colusa Canal to Glenn-Colusa Irrigation District Lateral 35-1C. Under this alternative, CVP water could be conveyed from Tehama-Colusa Canal through GCID Main Canal to GCID Lateral 35-1C. The water requirements for this alternative would be higher than for the other alternative plans because the total volume of water must include adequate water to provide a 10-mile long backwater pool in the GCID Main Canal that allows gravity diversion of water into Lateral 35-1C. Southeastern portions of the refuge would be served by gravity directly from Lateral 35-1C. Water would be pumped from Lateral 35-1C to GCID Lateral 26-2 to serve northern and southwestern portions of the refuge. The capacity of Lateral 35-1C would be increased to allow transport of the total flow volume for the entire refuge. To increase the capacity of Lateral 35-1C, a 30-inch diameter reinforced concrete pipe (RCP) culvert and two 36-inch diameter RCP culverts under roads which are used at road crossings would be replaced with 42-inch diameter culverts to eliminate the hydraulic restrictions. In addition, the lower portions of Lateral 35-1C would be cleaned. These improvements would increase the capacity of Lateral 35-1C from 25 cfs to 90 cfs. This alternative also would require a winter water source for the Tehama-Colusa Canal.

Alternative E - Implement a Conjunctive Use Plan. Under this alternative, ten wells could be constructed on the refuge to deliver 12,900 acre-feet of water, the estimated safe-yield of the refuge. The wells would probably deliver 1200 gpm from a pumping level of 100 feet (USBR, 1986c). The wells would be developed as part of a conjunctive use program.

3. Delivery Alternatives for Level 3

Water deliveries under Level 3 are similar to the current average water deliveries (Level 2). The primary difference between the levels is during the month of March when the proposed deliveries would be increased by 950 acre-feet. Additional deliveries during other months exceed Level 2 deliveries by 50 to 500 acre-feet per month. Therefore, the same alternatives considered for Level 2 could be evaluated for Level 3. The proposed facilities design capacities would be larger for Level 3 than Level 2.

4. Delivery Alternatives for Level 4

The entire Sacramento NWR currently receives water and would be fully developed under Level 3 water deliveries. Therefore, the alternatives for Level 4 (Level 4 being water required to fully develop the refuge) would be the same as discussed under Levels 2 and 3.

5. Summary of Alternatives

There are no alternatives for Level 1 as no firm water supply exists. Alternatives A through E are considered for implementation of Levels 2, 3, or 4. The alternatives were primarily developed to provide water to the refuge during the winter when CVP water is not currently available from the Tehama-Colusa Canal. Alternative E provides groundwater which can be used as part of a conjunctive use program. However, because CVP water currently is not provided on a firm supply basis and sufficient groundwater is not available to meet all of the refuge needs, CVP water on a dependable basis will be necessary to meet management objectives.

All of the alternatives for Levels 2, 3, or 4 would require long-term conveyance agreements with GCID to transport water to the Sacramento NWR. Alternatives B, C and D require winter operations of the Tehama-Colusa Canal which may not occur in the future. Alternatives A, and E do not require winter operation of the Tehama-Colusa Canal and therefore would provide greater flexibility. However, Alternative B would require obtaining a long-term agreement with Kanawha Water District which may not be possible or cost-effective. Alternative A would require construction of flood gates on Stony Creek. However, Alternative A does not require construction and operation of additional lift stations and has a lower operating cost than Alternatives B, C, D, or E. Alternatives A and B include construction of improvements to GCID Lateral 26-2. Alternatives C and D include construction of improvements to GCID Lateral 35-1C. Alternative E would not provide adequate water to meet the total needs of the refuge.

C. COST & ECONOMIC ANALYSIS

Costs for the alternative plans to provide adequate water supplies under Levels 1, 2, 3, and 4 are presented in Table IV B-4 and the Design Estimates Appendix. The construction costs include factors to cover engineering, contingencies, and overhead. During the advanced planning phase, these costs will be refined further. Annual O&M costs include only the actual cost of delivering water. GCID charges the Service \$1.50 per acre-foot for wheeling water to the refuges. Under the Contract No. 14-06-200-8181A, the Glenn-Colusa Irrigation District receives one acre-foot of wheeling through the Tehama-Colusa Canal for each acre-foot delivered to the refuge, thus avoiding the contract wheeling charge or \$1.50 per acre-foot which is then absorbed by the Reclamation.

Construction of the facilities under Alternatives A and E would result in additional money being spent in the economy of Glenn and Colusa Counties during the construction period. The construction could be completed within one summer season by construction workers who reside within the area.

TABLE IV B-4
SUMMARY OF ESTIMATED COSTS OF ALTERNATIVES
SACRAMENTO NWR

Items	Water Delivery Levels 2, 3, & 4 Alternatives				
	A	B	C	D	E
Total Construction Costs	\$520,000	\$176,000	\$732,000	\$170,000	\$560,000
Power Costs (\$/acre-foot)	0.00	1.75	1.75	1.00	12.50
Water Wheeling Costs (\$/acre-foot)	2.50	2.50	2.50	2.50	0.00
Annualized Construction Costs (8.875%, 30 Years)	50,020	16,930	70,420	16,350	53,870
Annual Operations & Maintenance Costs	1,100	2,500	3,560	2,500	16,000
Annual Power Costs	0	87,500	87,500	50,000	161,250
Annual Water Wheelage Costs	125,000	125,000	125,000	125,000	0
Total Annual Cost	\$176,120	\$231,930	\$286,480	\$193,850	231,120

Alternative A - Construct flood gate on Stony Creek

Alternative B - Deliver CVP water through Kanawha Water District

Alternative C - Construct Pipelines to transport CVP water from Tehama-Colusa Canal

Alternative D - Deliver CVP water from T-C Canal to GCID Lateral 35-1C

Alternative E - Conjunctive Use

Currently, the annual public use at Sacramento NWR is about 40,000 visits per year. Because all of the refuge is developed, the additional water may not increase public use levels significantly.

D. WILDLIFE RESOURCES

The annual waterfowl use on the Sacramento NWR is approximately 63,005,000 use-days based upon census data from 1980 and 1981. Approximately 75 and 18 percent of the waterfowl use are by ducks and geese, respectively, including many species which nest on the refuge. Wildlife and fishery resources associated with the refuge are presented in Table IV B-5. The only listed threatened and endangered species associated with Sacramento NWR are the bald eagle, Haliaeetus leucocephalus; peregrine falcon, Falco peregrinus; Aleutian Canada goose, Branta canadensis leucopareia; and the valley elderberry longhorn beetle, Desmocerus californicus dimorphus. Candidate species associated with the Sacramento NWR include the white-faced ibis, Plegadis chichi; tricolored blackbird, Agelaius tricolor; and California hibiscus, Hibiscus californicus, as listed in Table IV B-6.

The alternative plans would provide a firm water supply throughout the Sacramento NWR which is already totally developed within the boundaries of the refuge. Therefore, the water would be used to improve habitat and not to develop additional wetlands. The improved habitat would increase the number of waterfowl use days, as indicated in Table IV B-7.

Implementation of the alternative plans would not adversely effect the listed and candidate threatened and endangered species of birds and would improve habitat that could be used by the white-faced ibis and aleutian Canada goose. Detailed field investigations would be required during the advanced planning phase of the project. Implementation of a plan would result in overall beneficial environmental effects. The No Action Plan could result in the loss of habitat if interim water supplies are not available in the future. The results of the preliminary environmental account analysis for the alternative plans are presented in the Environmental Appendix. Additional environmental analyses will be completed as part of the Water Contracting EIS's.

E. SOCIAL ANALYSIS

The social consequences of constructing and operating the facilities of the alternative plans and improving the GCID facilities would be positive due to the potential increase in public use and the shared benefit to GCID of providing improvements to its water conveyance facilities. The local social environment is discussed in the Social Appendix.

TABLE IV B-5
WILDLIFE RESOURCES
SACRAMENTO

Ducks

Hooded Merganser	Blue-Winged Teal ^(a)	Ring Necked Duck
Mallard ^(a)	Northern Shoveler ^(a)	Common Goldeneye
Gadwall ^(a)	Pintail ^(a)	Greater Scaup
European Wigeon	Wood Duck ^(a)	Lesser Scaup
American Wigeon	Redhead ^(a)	Buffle Head
Green winged Teal ^(a)	Canvasback	Common Merganser ^(a)
Cinnamon Teal ^(a)	Ruddy Duck ^(a)	

Geese and Swans

Snow Goose	White-fronted Goose	Cackling Canada Goose
Ross' Goose	Canada Goose	Lesser Canada Goose
		Whistling Swan
		Tundra

Coots

American Coot^(a)

Shore and Wading Birds

Western Grebe ^(a)	Virginia Rail ^(a)	Common Snipe
Eared Grebe	Sora ^(a)	Long-billed Dowitcher
Pied-billed Grebe ^(a)	Common Gallinule ^(a)	Least Sandpiper
Double-crested Cormorant	Ring-billed Gull	Dunlin
White Pelican	Caspian Tern ^(a)	Western Sandpiper
American Bittern ^(a)	Forester's Tern	Greater Yellowlegs
Least Bittern ^(a)	Black Tern ^(a)	Long-billed Curlew
Great Blue Heron ^(a)	Wilson's Phalarope	Killdeer ^(a)
Great (common) Egret ^(a)	American Avocet	Black-crowned Night Heron ^(a)
Snowy Egret ^(a)	Black-Necked Stilt	Greater Sandhill Crane
Green-backed Heron ^(a)		

TABLE IV B-5
WILDLIFE RESOURCES

SACRAMENTO
(Continued)

Upland Game		
Ringed-neck Pheasant ^(a)	Rock Dove	Mourning Dove ^(a)
Raptorial Birds		
Turkey Vulture	Black-shouldered Kite ^(a)	Northern Harrier
Sharp-shinned Hawk ^(a)	Cooper's Hawk ^(a)	Red-tailed Hawk ^(a)
Rough-legged Hawk	American Kestrel ^(a)	Barn Owl ^(a)
Great Horned Owl ^(a)	Red Shouldered Hawk ^(a)	Golden Eagle
		California Quail ^(a)
Fish		
Steel head	Salmon	Largemouth Bass
Catfish	Black Crappie	
Furbearers		
Opposum	Gray Fox	Coyote
Raccoon	Beaver	Mink
Skunk	Muskrat	
Others		
	Black-tailed Deer	

Notes:

(a) Birds nesting on refuge

Source: USFWS computerized annual printout for NWR Birds, Department of Interior, USFWS (RF11650-2 9-79) (July 1973 to June 1974, NWRS Public Use Report (1)) and refuge records.

TABLE IV B-6

LISTED, PROPOSED, & CANDIDATE, THREATENED & ENDANGERED SPECIES
SACRAMENTO NWR

Listed Species

Birds

Aleutian Canada goose, Branta canadensis leucopareia (E)
Bald Eagle, Haliaeetus leucocephalus (E)
Peregrine Falcon, Falco peregrines (E)

Invertebrates

Valley elderberry longhorn beetle, Desmocerus californicus dimorphus
(T)

Proposed Species

None

Candidate Species

Birds

White-faced ibis, Plegadis chihi (2)
Tricolored blackbird, Agelaius tricolor (2)

Plants

California hibiscus, Hibiscus californicus (2)

Source: USFWS, June 4, 1987

- (E)—Endangered (T)—Threatened (CH)—Critical Habitat
(1)—Category 1: Taxa for which the Fish and Wildlife Service has sufficient biological information to support a proposal to list as endangered or threatened.
(2)—Category 2: Taxa for which existing information indicated may warrant listing, but for which substantial biological information to support a proposed rule is lacking.

TABLE IV B-7
WILDLIFE RECREATIONAL BENEFITS AND RESOURCE IMPACTS
SACRAMENTO NWR

Item	Water Delivery Levels			
	Level 1	Level 2	Level 3	Level 4
Habitat Acres				
Permanent Pond	0	115	125	125
Seasonal Marsh	0	6,180	6,200	6,200
Watergrass	0	565	600	600
Rice	0	287	300	300
Bird Use Days				
Ducks	0	48,550,000	50,000,000	50,000,000
Geese	0	11,200,000	11,500,000	11,500,000
Waterbirds	0	3,065,000	3,100,000	3,100,000
Endangered Species	0	180	180	180
Public Use Days				
Consumptive	0	7,000	7,000	7,000
Non-Consumptive	0	32,900	33,000	33,000
Annual Recreational Benefits	0	\$ 864,230	\$ 866,400	\$ 866,400

F. POWER ANALYSIS

The Pacific Gas & Electric Company (PG&E) serves the Sacramento NWR under the PA-1 rate schedule for agricultural users. The electric power that the CVP powerplants generate is dedicated first to meeting the power requirements of the CVP facilities, or project-use requirements. After project-use requirements are met, remaining power is used to provide commercial power to preferential customers. The amount of commercial power that is available is dependent upon the project dependable capacity and the long-term average annual generation. The project dependable capacity is that portion of the electric generating capability that can be relied upon to meet the commercial loads under the most adverse hydrologic conditions. The long-term average annual generation is the average annual energy production that could be generated over a long-term period based on historical hydrological data.

Power generated at CVP powerplants is directly related to demands for CVP water. Recognizing that these water demands would be seasonal, CVP powerplants were designed to provide peaking power during the summer months. Because peaking power alone cannot satisfy the power requirements of the CVP power customers and because peaking power is more efficiently used when integrated with a baseload power, the Reclamation entered into Contract 14-06-200-2948A (Contract 2948A) with PG&E. The Western Area Power Administration, U.S. Department of Energy, administers this contract which provides for delivery of surplus power from CVP powerplants into the PG&E system. PG&E, in return, delivers power as required to CVP power customers and to some project-use facilities.

The Reclamation instructions limit the allocation of project-use power to facilities that are directly involved in the conveyance or delivery of water. Contract 2948A defines many of the restrictions on delivery of power for both project-use and preference customers. The contract specifies that the service will be limited to loads within the wheeling boundaries for project-use and preference customers. All of the refuges considered in this report, except Modoc NWR, are within the wheeling boundaries. Conveyance of power for preference customers is restricted to entities that have monthly maximum demands of 500 kW or more for three consecutive months. For project use, wheeling is restricted to facilities with a maximum demand of 100 kW or more for three consecutive months. In addition, PG&E is not required to deliver power at a voltage of less than 2 kV. PG&E has interpreted these restrictions to mean that the 500-kW or 100-kW load has to be situated at the same meter. Any transmission line connecting portions of this load has to be purchased by the project-use or preference customer and the transmission line becomes part of the customer's distribution system. The Sacramento NWR would have a power requirement that would exceed the preference customer limit.

Contract 2948A requires project-use pumping plants to be operated to the maximum extent practical outside of the PG&E peak-load period. When the plants are operated on-peak, CVP powerplants must supply the project-use power directly. Therefore, if the refuges were to receive project-use power, the on-peak power use would be minimized.

A facility must be an authorized function of the CVP to receive project-use power. The authority to deliver power to the refuge is currently being examined and will be detailed in the Refuge Supply Planning Report.

If it is determined that the refuge does not qualify for CVP project use power, the refuge must purchase power as a preference customer. There are many more requests for preference power than supply. The existing power supply has been allocated through contracts that expire in 1994. A marketing plan is being developed for future contracts that will be signed in 1994. The potential is not high for refuges to become preference customers until after 1994. The Service recently applied to receive CVP power for the NWR's in the Central Valley as well as for the Coleman National Fish Hatchery. Only the request for the fish hatchery was granted. DFG also applied to receive CVP power for the Gray Lodge Wildlife Management Area, however this request also was not granted.

G. PERMITS

Construction of the removable floodgates and improvements to GCID Lateral 26-2 headgates under Alternative A, or wells and improvements to Lateral 26-2 under Alternative E, would require several permits. Glenn and Colusa Counties would issue permits for well construction and approvals for construction along the banks of Stony Creek to ensure that existing drainage facilities would not be adversely effected. If water is transferred through Stony Creek from the Tehama-Colusa Canal to the GCID Main Canal, approvals from California Department of Water Resources and State Water Resources Control Board also may be required. The lift station constructed at the intersection of Stony Creek and the GCID Main Canal would require a Stream Alteration Permit from the California Department of Fish and Game and a Corps of Engineers permit for construction in wetlands. Agreements with GCID for water conveyance would be required for either of the alternatives.